IN THE UNITED STATES DISTRICT COURT FOR THE
NORTHERN DISTRICT OF OKLAHOMA

W. A. DREW EDMONDSON, in his capacity as ATTORNEY GENERAL OF THE STATE OF OKLAHOMA and OKLAHOMA SECRETARY OF THE ENVIRONMENT C. MILES TOLBERT, in his capacity as the TRUSTEE FOR NATURAL RESOURCES FOR THE STATE OF OKLAHOMA,	)
Plaintiff,	)
vs.	) 4:05-CV-00329-TCK-SAJ
TYSON FOODS, INC., et al,	)
Defendants.	)

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DEPOSITION OF INDRAJEET CHAUBEY, PhD, produced as a witness on behalf of the Plaintiff in the above styled and numbered cause, taken on the 27th day of January, 2009, in the City of Tulsa, County of Tulsa, State of Oklahoma, before me, Lisa A. Steinmeyer, a Certified Shorthand Reporter, duly certified under and by virtue of the laws of the State of Oklahoma.

Exhibit E

APPEARANCES

FOR THE PLAINTIFFS: Mr. Richard Garren
Attorney at Law
502 West 6th Street
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-and-
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FOR TYSON FOODS: Mr. Robert George
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FOR CARGILL: Ms. Leslie Southerland
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100 West 5th Street
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FOR PETERSON FARMS: Ms. Nicole Longwell
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FOR GEORGE'S: Ms. K. C. Tucker
Attorney at Law
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FOR CAL-MAINE: Mr. Robert Sanders
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(Via phone)

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(Whereupon, the deposition began at 8:52 a.m.)

COURT REPORTER: We are now on the Record. Would counsel please announce themselves?

MR. GEORGE: Robert George for the Tyson defendants. 08:52AM

MR. SANDERS: Bob Sanders for the Cal-Maine defendant.

MS. TUCKER: K. C. Tucker for the George's defendants. 08:53AM

MS. SOUTHERLAND: Leslie Southerland for Cargill.

MS. LONGWELL: Nicole Longwell on behalf of Peterson Farms.

MR. GARREN: We have Richard Garren for the State of Oklahoma. 08:53AM

MR. BULLOCK: And Louis Bullock for the State of Oklahoma.

INDRAJEET CHAUBEY, PhD

having first been duly sworn to testify the truth, the whole truth and nothing but the truth, testified as follows:

DIRECT EXAMINATION

BY MR. GARREN:

Q Dr. Chaubey, would you please tell the court 08:53AM

your full name?
A Indrajeet Chaubey.
Q All right. Dr. Chaubey, have you ever given a deposition before?
A No, I have not. 08:53AM
Q What's going to occur today -- let me give you some helpful hints, if you will, about what we are doing. I'll ask questions. At some point in time there may be other attorneys to ask questions, too, but the intent here is, because we have a court 08:53AM reporter, that your responses be made audibly so she can take down your response, and it's even more important today since we're doing a lot of people on the phone. Secondly, if you don't understand my question or others' questions, please let me know or 08:54AM indicate that you are not able to understand it and I'll try to rephrase it so that we're clear in our understanding of what I'm asking and what it is you are responding to. All right? You'll need to respond verbally then. Do you understand that? 08:54AM
A Yes.
Q All right, and I know you do have a dialect, and we've spoken before, so I will try to do my best not to speak over you, and if you'll do the same with me, I'll try and get my questions in, and I'll 08:54AM

wait for you to finish your answer before asking another one so that the court reporter can get that down. With others being on the phone today and making objections, it will be a little more distracting I think so if they do make an objection, 08:54AM wait until it's completed and then we'll go forward with your responses. All right?
A Okay.
Q We will take periodic breaks. At any time you feel like you want to take a break and we haven't 08:54AM taken one, let me know and we'll do that. All right?
A Okay.
Q Tell the court where you reside.
A I live in West Lafayette, Indiana. 08:55AM
Q And you're employed there; correct?
A I am employed at Purdue University.
Q Since you agreed to appear and testify, have you been contacted by any of the poultry integrator defendant lawyers in this case? 08:55AM
A Yes. I got subpoena and a phone call from Robert George and Michael --
Q Bond?
A Bond, yes.
Q All right. When did that call occur; do you 08:55AM

remember?
A It occurred last week.
Q All right, and they called you?
A Yes.
Q And what did they say when they called you? 08:55AM
A I guess the conversation was they wanted to know if I was a paid expert on this case and if I was going to take any side and wanted to know what it was going to be about.
Q And did you respond to their question whether 08:55AM you were a paid expert?
A Yes, I did respond to that question.
Q What was your response?
A I am not a paid expert.
Q All right. Did they ask you any other 08:56AM questions or make any other statements to you in that conversation?
A I recall I think one of the questions was if I understood some of the comments I make could potentially determine the liability in this case. 08:56AM
Q Did those statements to you make you feel uncomfortable in any way?
A No, it did not.
Q Okay. Now, you and I have spoken before today; is that correct? 08:56AM

A Yes.
Q One time at your office and one time in my office yesterday; is that true?
A Yes.
Q All right. In those discussions, were you 08:56AM asked to say anything you could not believe was true?
MS. LONGWELL: Object.
A No.
Q Has anyone for the State of Oklahoma or its 08:57AM attorneys requested that you render an opinion in connection with the facts in this case?
A No.
Q Have you seen the complaint filed by the State of Oklahoma against the poultry integrator 08:57AM defendants in this case?
A No.
Q Do you know, in fact, who all the defendants are in this case?
A No, I do not. 08:57AM
Q You heard lawyers this morning announce for various companies, did you not?
A Yes.
Q Other than that, have you heard the names of the defendants in this case? 08:57AM

A No. This is the first time I heard some of those names.
Q Do you know a gentleman by the name of Bernard Engel?
A I know him.
Q How long have you known him?
A We have worked together for a little over two years now, and I've known him for more than seven or eight years.
Q All right, and where did you first meet him; do you recall?
A We first met in a conference, our professional American Society of Agricultural and Biological Engineering Conference.
Q All right. Have you looked at or read Dr. Engel's expert report that he prepared for this case?
A I have not.
Q Have you looked at any parts of it?
A No.
Q Have you discussed with Dr. Engel the nature and scope of his opinions contained in that report that he has prepared for this case?
A No, I have not.
Q Have you seen or read any of the expert

reports submitted by the defendants in this case?
A No.
Q Have you looked at any or read any reports submitted by other experts submitted by the State of Oklahoma in this case?
A No.
Q Do you know the names of the experts used by the State of Oklahoma in this case?
A I do not.
Q Do you know the names of the experts used by the defendants in this case?
A I do not.
Q Have you been asked at any time to perform work for any expert who's identified himself to be an expert in this case?
A Can you ask that question again?
Q Have you been requested by any person identifying themself to be an expert in this case to do work for them?
A No.
Q Have you looked at or read any transcripts of either Dr. Engel or others in this case?
A No.
Q Have you been provided any data that was gathered by the State or people working on behalf of

the State of Oklahoma in this case?
A No.
Q Have you been provided any data provided through the defendants in this case?
A No.
Q What, if any, encouragement or discouragement has Dr. Engel provided to you for your testimony today, if any?
A None.
Q Has Dr. Engel put any pressure on you to testify?
A No, he has not. I don't see how he can put pressure. I'm a tenured professor at Purdue. So no one can.
Q Have you been promised anything for your testimony in this case?
A No.
Q Have your expenses been paid to come to Tulsa?
A Yes.
Q And what expenses were those?
A Airfare and hotel.
Q All right. Have you, sir, in your professional career at any time been requested directly by any of the defendants in this case to perform consulting work on their behalf?

A No.
Q Have you performed any consulting work for the State of Oklahoma in the past?
A No.
Q Have you been retained to provide an opinion about the State of Oklahoma experts' opinions?
A No.
Q Have you been retained to consult with any of the State's experts on any issue in this case?
A No.
Q Have you been retained by anyone to provide opinions as to the defendants' experts' opinions?
A No.
Q Other than coming to testify today in Tulsa, have you been asked by me or others for the State of Oklahoma to do any work on this case?
A No.
Q Other than your coming today to testify, have you been asked by me or others for the State of Oklahoma to form any opinions specifically in connection with this case?
A No.
Q Let's talk a little bit about you, Dr. Chaubey. I'm going to hand you what is Exhibit No. 1. I'll represent to you that this is a document

that I downloaded from the Purdue University, which appears to be, at least in part, a curriculum vitae. Would you agree with that?

A Yes.

Q And is this -- is the data that's on this maintained by you or under your direction? 09:02AM

A Under my direction.

Q Okay. Is the -- let's talk a little bit about -- first off, do you believe this is a full and complete curriculum vitae for you? 09:02AM

A This is not complete particularly. It only partially presents my work.

Q I'm going to ask some questions to give you an opportunity to kind of supplement some of the things on this. All right? 09:02AM

A Okay.

Q Let's start first with your degrees. You have the degrees listed here, and I'm going to take them in reverse order. Tell the court and the witnesses here, what is your bachelors of science degree in? 09:03AM

A My bachelors of science degree is in agricultural engineering.

Q And when did you obtain that degree?

A In 1991.

Q And at what university did you obtain that? 09:03AM

A It was from University of Allahabad in India.

Q Now, you've obtained a masters degree also. It's in biological and agricultural engineering. Where did you obtain that?

A At University of Arkansas. 09:03AM

Q And what year was that?

A 1994.

Q All right. Did you have a supervisor in your masters thesis work at that university?

A Yes. 09:03AM

Q Who was that?

A Dr. Dwayne Edwards.

Q Is he also known as D. R. Edwards?

A Yes.

Q All right. What was the thesis that you -- general subject matter of the thesis that you provided for your masters? 09:04AM

A I investigated how filter strips or buffer strips can be used as a best management practice to filter some of the water quality constituents from 09:04AM land-applied poultry litter and swine manure.

Q All right. You then obtained a PhD. Where was that obtained?

A Oklahoma State University.

Q And what was the degree obtained there? 09:04AM

A Biosystems engineering.

Q And what year was that degree obtained?

A 1997.

Q Did you have a thesis captain or director in your work there? 09:04AM

A Yes.

Q Who was that?

A It was Dr. C. T. Hahn.

Q What was the general subject of the thesis that you prepared for your doctorate? 09:05AM

A It was in the area of hydrology and watershed modeling. I investigated how different uncertainties relate to model inputs and parameters.

Q Okay. Let's talk a little bit about the awards and honors you have listed here. There are several, but are these all of the ones that you have obtained? 09:05AM

A No. Actually, what I consider the most significant is not listed here.

Q What is the award or honor that is significant to you that's not listed? 09:05AM

A It is New Holland Young Researcher Award. It is given by American Society of Agricultural and Biological Engineering to one researcher every year younger than 40 years old. 09:05AM

Q So what was the year of that?

A It was 2007.

Q And what is your age today?

A 40.

Q 40. Are there any other awards or honors you wish to list that aren't otherwise listed on Exhibit 1? 09:06AM

A No. The rest are.

Q Let's talk a little bit about your professional experiences. Other than those listed on this curriculum vitae, are there some omitted? Let me rephrase that. Are there other professional experiences that you think should be added to this that were not on it at the time this was prepared? 09:06AM

A I am involved in some committees and assignments at Purdue which are not listed here. For example, I am on a steering committee of ecological sciences and engineering, and I am a founding member of equivalent to board of directors on division of environmental and ecological 09:07AM engineering at Purdue.

Q All right. Are there any others?

A No. Rest of the significant ones are listed here.

Q All right. This particular document doesn't 09:07AM

have a listing for professional associations. Can you tell the court and jury what those may be?
A I am a member of American Society of Agricultural and Biological Engineering. I am also a member of American Water Resources Association, and two honor societies. One is Gamma Sigma Delta. It's honor society in agriculture, and second one is Alpha Epsilon, honor society in agricultural and biological engineering. 09:07AM
Q Are there any others that you can think of that you would wish to list today that aren't on this Exhibit 1? 09:07AM
A Not really.
Q All right. Exhibit 1 does not list all of your publications, does it? 09:08AM
A No, it does not.
Q All right. Let me hand you what's marked as Exhibit No. 2, and I would represent to you this is another download that I obtained from the website there at Purdue. Can you identify this document for the court, please? 09:08AM
A Yes. It is from my website. It is a list of my publications, presentations, seminars, research reports and other similar documents.
Q In looking at this list yesterday, did you 09:08AM

located in Arkansas; some are located in Indiana.
Q Are the ones in Arkansas connected to the or related to the Illinois River watershed?
A Yes.
Q Are you familiar with that watershed? 09:10AM
A I am.
Q Do you know the boundaries of it generally speaking?
A You mean boundaries of the Illinois River watershed? 09:10AM
Q Of the Illinois River watershed.
A I understand the boundaries of the Illinois River watershed.
Q Okay. Are there subwatersheds that you have also been working with within the Illinois River watershed? 09:10AM
A Yes.
Q What would that be?
A That will be Moores Creek, Lincoln Lake watershed, which is a small subwatershed within IRDA or Illinois River drainage area. 09:11AM
Q Okay. So I think I understand what you are saying. Is the area you are speaking to only in Arkansas and not Arkansas and Oklahoma?
A Yes. 09:11AM

determine whether it was complete or not?
A It is not most up to date. It says that I have 39 refereed journal articles. Since then that number has increased to 43.
Q Let me hand you what I'm going to mark as Exhibit 2A. Tell the court what that is. 09:09AM
A It comes from my letter CV. It is a list of -- first page of my list of publications, and it has got three additional refereed journal articles which are not on the website. 09:09AM
Q Did you provide that document to me yesterday?
A I gave that to you yesterday.
Q All right. Are there any other publications you may be currently working on that also are not on this list? 09:09AM
A Yes. There are a number of publications which are currently in progress.
Q Generally what is the scope or nature of those and the subject matter that might be being investigated? 09:10AM
A They all relate to non-point source pollution and hydrology in agricultural watersheds.
Q What watersheds do they relate to that you are doing this work in?
A A number of different watersheds. Some are 09:10AM

Q All right. So the subwatershed, does it have a name?
A Moores Creek watershed. It is also at times referred as Lincoln Lake watershed.
Q All right. Has it ever been referred to as Muddy Fork; do you know? 09:11AM
A It is part of the Muddy Fork watershed, yes.
Q Okay. Let's talk a little bit about your employment history, if we can, sir. Starting with when you were still studying -- or tell me when was the first time that you took a paid position in or around your bachelors degree or after it, sometime in that starting time frame. 09:11AM
A So in 1992 in January I started my masters degree at the University of Arkansas, and I was a half-time research assistant, working 20 hours a week on a research project. 09:12AM
Q What was the nature of the project that you were working on there?
A I was involved in looking at land application of poultry litter and swine manure and how that results in water quality, constituent transport in small controlled plots, and what different best management practices could be considered to minimize that impact. 09:12AM

Q With regard to that work, did it include bacteria transport as part of those constituents?
A Yes, it did.
Q All right, and that period of time was from -- what were the dates of that work? 09:13AM
A So it went from January 1992 to July 1994.
Q Okay. Did you then obtain employment after that work in July of '94?
A I started my PhD in August of 1994 at Oklahoma State University, and I was a half-time research assistant there, working 20 hours a week.
Q What kind of work were you performing as a half-time research assistant?
A I was involved in looking at hydrologic and water quality models, how do they work in different watersheds, how we can improve them, how we can reduce their uncertainty.
Q Did you meet a gentleman by the name of Dr. Storm while at OSU?
A Dr. Daniel Storm, yes.
Q And did he participate in your PhD studies in any way?
A He was a member of my PhD committee.
Q After October '97, did you have additional employment? 09:14AM

A Yes.
Q Tell us what that was.
A I was assistant research scientist at University of Alabama from October 1997 until April 2000.
Q And what kind of work did you do as an assistant research scientist there?
A I worked as a hydrologist and water quality modeler, again, in general, looking at water response to runoff, sediment, nutrients.
Q Was that a full-time employment?
A That was a full-time employment.
Q After April 2000, did you secure employment elsewhere?
A I became assistant professor at University of Arkansas.
Q And what was the time frame that you were at University of Arkansas?
A So from May 2000 until December 2006 I was there.
Q All right, and did your position as an assistant professor change at any time during that period?
A In 2005 I became -- I got tenured and I was promoted to associate professor.

Q All right. Where did you go after leaving University of Arkansas in December of '06?
A So in January of 2007 I became associate professor at Purdue University.
Q And were you hired there as a tenured professor? 09:15AM
A No, I was not hired there as a tenured professor. I got tenure last year.
Q You mentioned that you had done some work in the watershed of Indiana and then you've talked about the Illinois River watershed. Are there any other watersheds that you've had experience with besides those two? I say two. Let me back up. How many Indiana watersheds have you been involved with in doing your work or study? 09:16AM
A At least half a dozen of Indiana watersheds I'm working on right now.
Q Other than the Illinois River watershed, are there others in Arkansas that you've done work in?
A I've worked in Beaver Lake watershed. I was involved in Eucha-Spavinaw watershed and a number of what I call priority watersheds in Arkansas.
Q What kind of watersheds?
A Priority watersheds.
Q Priority watersheds, okay. Just briefly tell the court, if you would, what kind of areas of study or investigation you were conducting in these various watersheds; are they consistent with what you've done in your degrees? 09:17AM
A Yes. They are all related to agricultural watersheds and looking at different processes related to hydrology and water quality, how do these processes affect what gets transported from these watersheds, how we can mathematically model them and what kind of different management practices we can evaluate to see what happens.
Q All right. How long now have you then -- I want to speak now basically about the Illinois River watershed or its subbasins. How long have you been directly involved in studying or investigating that watershed or its subbasins? 09:18AM
A My masters thesis was based on work in the Illinois River watershed, and then when I came back as a faculty in 2000, since then I have been involved in a number of projects in the watershed.
Q All right. So some of that work was in the early '90's and then again starting in around 2000?
A Yes.
Q All right. Did your work in the watershed include what I called field work study? 09:18AM

MS. LONGWELL: Object, form.
A Yes.
Q Tell the court what field work study would be.
A Field work study would involve instrumenting, collecting data at the field scale and our 09:18AM
developing mathematical models to investigate what happens in terms of hydrology and water quality at a scale typical of a field.
Q Do you have experience in actually taking samples then while in the field? 09:19AM
A I have done a lot of field experimentation and have been involved directly in collecting field data.
Q Has your experience involved setting up instrumentation which would remotely or 09:19AM automatically collect data also?
A Yes.
Q In your work in the Illinois River watershed, have you relied solely on just the data that you've collected or others under your supervision? 09:20AM
A Ask that question again.
Q In your work in the Illinois River watershed, is that work, and certainly the papers you've written, relying solely on the data that you collect or would it include data from others? 09:20AM

A No. It does involve data and publications from others who have worked in the watershed.
Q So you have read published literature that would have some impact on your study or investigation; is that correct? 09:20AM
A Yes.
Q Based on your experience, how would you characterize the volume of published literature and data that involves the Illinois River watershed?
A It is, in my opinion, a very well studied 09:20AM watershed. Compared to lots of other watersheds that I have experienced or seen, it is a data-rich watershed.
Q Do you know whether or not research and study is still ongoing with regard to the Illinois River 09:21AM watershed? By others first, let's ask that. Do you know if others are still doing studies in the Illinois River?
A I don't know for sure. There was some studies going on when I left and was different assignment to 09:21AM Purdue, so I assume they are still continuing.
Q Are you continuing to do any work in the Illinois River watershed?
A Yes.
Q And that area of work involves what? 09:21AM

A I am funded by USDA to study in Lincoln Lake watershed different best management practices, how do they work, and some of the socio-economic factors associated with BMP adoption, implementation and maintenance. 09:22AM
Q Do you have any estimate of how long that work is going to continue?
A We are in fourth year of that project, so that will end in September of '09.
Q All right. Tell me, what are some of the 09:22AM sources of data that you have reviewed either through literature or downloaded that became part of your study or your work or your experience?
MS. LONGWELL: Object to form.
A Besides my own data, I have worked with the 09:22AM data that have been collected by Arkansas Water Resources Center, Arkansas Natural Resources Commission and Arkansas Department of Environmental Quality. I have worked with some GIS data that have been compiled and are housed by Center For Advanced 09:23AM and Special Technology, which is part of University of Arkansas. So they come from a variety of sources.
Q Is USGS also a source?
A Yes, of course, USGS is also a source of that 09:23AM

data.
Q And at any time do you rely on USDA publications and censuses and similar data?
A Yes.
Q You've mentioned Arkansas Water Resource 09:23AM Center. Tell the court what that is and what kind of job it performs.
A Arkansas Water Resources Center is a center. I believe every state in the U.S. has got a similar center. The name may or may not be exactly the 09:24AM same. It's partially funded by USGS, by federal government, and mandated to work with and compile studies related to hydrology and water quality in the state.
Q When you were at the University of Arkansas, 09:24AM were you working in or with the AWRC?
A I worked quite a bit with AWRC.
Q All right. Who were some of the other people there that were at the AWRC when you worked there?
A Dr. Marc Nelson, who was with AWRC, he was my 09:24AM collaborator on almost all of the projects that involved data collection. I worked with Dr. Ralph Davis.
Q Ralph Davis?
A Yes. 09:25AM

Q All right.
A And I did some work with Dr. Tom Soerens.
Q Would you confer with others there besides the ones you've just mentioned?
A Would I confer with others? 09:25AM
Q Yeah, others that you've not mentioned in any of your work.
A Yes.
Q Did you peruse the literature and review it that's generated out of the Arkansas Water Resource Center during your work there? **09:25AM**
A Yes.
Q So how long were you connected with work at the Water Resource Center there?
A From 2000 to 2006 until I left for Purdue. 09:25AM
Q Okay. Describe generally the nature of the work that you performed while at the Arkansas Water Resources Center.
A So I was collaborating with Arkansas Water Resources Center. I want to make it clear. I was 09:26AM not employed at the Arkansas Water Resources Center.
Q So you were actually employed by the university and collaborated --
A Yes, collaborated with AWRC, and AWRC was facilitating a few of my projects. What was the 09:26AM

question again? I'm sorry.
Q Well, I guess you probably answered my question, but generally what was the scope of the work that you performed, the nature of the subject that you studied? **09:26AM**
A They all related to agricultural watersheds, hydrology, water quality from non-point source pollution.
Q And did you conduct field investigations through your collaboration with AWRC? **09:27AM**
A Yes.
Q In your work at Arkansas, did you have an opportunity to acquaint yourself with the type of agricultural practices that are performed in the IRW? **09:27AM**
A Yes.
Q Describe generally what is the makeup of the IRW as you observed it.
A Do you mean --
Q Land use, let's start with land use. What kind of or land types do you see in the watershed? **09:27AM**
A The watershed is a mixed land use watershed. It's predominantly pasture areas. I believe about 55 percent of the watershed is pasture.
Q All right. **09:28AM**

A About 35 percent is forest. So that's about 90 percent, and rest are in other categories.
Q All right. Do you know what the approximate percentage of the urban area is in the Illinois River watershed? **09:28AM**
A So it has to be less than 10 I would think. More like 6 or 7 percent; no more than that.
Q Based on your knowledge and skill and education, training and experience, including reading published literature, do you have an opinion what is the primary method used for poultry waste disposal? **09:28AM**
MS. LONGWELL: Object to form.
A Yes.
Q What is that opinion? **09:28AM**
A Land application, surface application of poultry litter.
Q All right. From your review of published literature, do you have any knowledge of approximately how long land application of poultry waste has occurred in the IRW? **09:29AM**
MS. LONGWELL: Object to form.
A Can you ask that question again?
Q I will. From your review of literature or other sources, do you have knowledge of **09:29AM**

approximately how long poultry waste has been generally land applied in the IRW?
MS. LONGWELL: I'm just going to state a continuing objection to the term waste. I think that's traditional, but that way I'm not going to 09:29AM continue to object just because you use that word.
MR. GARREN: All right.
A Yes.
Q Approximately how long have you learned that would be? **09:29AM**
A For a long time. I mean, since poultry industry has been concentrated in northwest Arkansas.
Q All right. When I use the term waste, let me maybe define that so that you and I have an understanding, too. I define waste as the excrement, the bedding material and things such as feathers or wasted feed and moisture that occurs that's taken out of the house at the conclusion of the growing session, sometimes commonly referred to as poultry litter in Arkansas. Do you know the term poultry litter? **09:29AM** **09:30AM**
A Yes.
Q And can you tell me what you understand the term poultry litter would mean? **09:30AM**

A Poultry litter indicates a combination of poultry manure and bedding material that is in poultry houses, what comes out after cleaning.
Q All right. So if I use the term poultry waste, do you understand that it's similarly as you've defined poultry litter? 09:30AM
MS. LONGWELL: Object to form.
A Yes.
Q Okay. Based upon your experience, knowledge, review of published literature, do you have an opinion of how far from the poultry barn the poultry waste is usually taken to be land applied? 09:31AM
MR. GEORGE: Object to the form. Rick, I want to elaborate for a moment on my objection. It's apparent to me that the plaintiffs are now trying to solicit opinions from Dr. Chaubey beyond those that he has previously expressed in any literature, and by virtue of that, are trying to turn Dr. Chaubey into yet another expert witness for the State of Oklahoma, and the opinions that are elicited in this deposition in that context are untimely, and the defendants object to it. 09:31AM
MR. GARREN: And in response, I'm certainly asking him from his personal experience facts and other observations he's made, and I will reask the 09:31AM

question.
Q Based upon your personal experience, your observations, including your training and reading of published literature, do you have any idea or opinion about how far waste is generally taken from the poultry barn to be land applied? 09:32AM
MR. GEORGE: Same objection.
MS. LONGWELL: Object to form.
A Yes.
Q Tell us what you know. 09:32AM
A My understanding is that it does not travel too far. Economically it's not viable to transport poultry litter beyond a few kilometers from where it's generated.
Q With regard to that poultry litter or waste, in your study and in your investigations revolving around BMPs and water quality, is it important to know when poultry waste is land applied? 09:32AM
MS. LONGWELL: Object to form.
A Yes. 09:32AM
Q And in your work in the IRW, have you learned from either personal experience, observation or published literature, when poultry waste is generally applied, when it is? What time of year is my question. 09:33AM

A Mostly in the spring, from the spring until into the fall pretty much.
Q All right. In your study and investigation of poultry waste, its use and its effect on water quality, have you learned the nature and extent of the constituents contained within it? 09:33AM
MS. LONGWELL: Object to form.
A Yes.
Q What have you learned is the general constituents of poultry waste? 09:33AM
A The microconstituents are water, carbon, nitrogen and phosphorus, and there are some micronutrients such as copper, iron, arsenic and others.
Q Is zinc one of the micronutrients that are found? 09:34AM
A I think so.
Q Does poultry waste to your knowledge contain bacteria?
A Yes. 09:34AM
Q You mentioned earlier that you've done work in Moores Creek. Let me hand you what is Exhibit 3. Can you tell the court what this document is?
A This is a final report for a project named Optimizing BMPs, Water Quality and Sustained 09:35AM

Agriculture in the Lincoln Lake Watershed that I and my team have prepared for Arkansas Soil & Water Conservation Commission.
Q All right. Who are the other authors or persons on your team identified in this Exhibit 3? 09:35AM
A So from biological and agricultural engineering department, Dr. Tom Costello. He's an associate professor, and Dr. Kati White. She was at that time my PhD student. Since then she has graduated and become faculty member at University of Florida. Dr. Marc Nelson from Arkansas Water Resources Center, and Michelle Steele. She is an extension agent with Northwest Arkansas Cooperative Extension Service. 09:35AM
Q What was Dr. Nelson's role in this work that's being reported in Exhibit 3? 09:35AM
A He was leading there to collect water samples from Moores Creek and Lincoln Lake.
Q You mentioned earlier that you've worked with him at the Arkansas Water Resource Center in the past; correct? 09:36AM
A Yes.
Q Do you have an opinion about his ability to collect and compile sampling data?
A He has very extensive experience and lots of 09:36AM

expertise. I've got very high regards for his abilities to collect water samples and analyze them.

Q In this reported study, did you rely then on his collection and compiling of water quality samples? 09:36AM

A Yes.

Q Do you know whether or not others at the Arkansas Water Resource Center rely on Dr. Nelson's collection and compiling of water quality samples?

A Others at the Water Resources Center or others at the university? 09:36AM

Q Either one or both.

MS. LONGWELL: Object to form.

A Yeah.

Q They do? 09:37AM

A Yes.

Q Okay. What is the date of this publication; do you know approximately when it was published?

A I think it was published in 2005.

Q Okay. By looking at this report, do you know the dates of collection of the data that was used in this report? 09:37AM

A I think it went from 2001 to 2004.

Q All right. In your work in this particular study -- well, let me just look. I think the report 09:37AM

the Ozark Highlands of Arkansas have been linked to agricultural activities in the area, and it cites Edwards and Daniel for 1992 and Edwards and others for 1997. Are you familiar with these gentlemen?

A Yes. 09:39AM

Q Are you familiar with the work that's cited in this document?

A Yes. I had read the papers at that time.

Q All right. Based upon your knowledge, experience and review of that work, do you have an opinion whether the statement made by Edwards and Daniel is an accurate statement? 09:40AM

MS. LONGWELL: Object to form.

MR. GEORGE: Object to form, speculation and calls for new opinion. 09:40AM

A Yes.

Q What is that opinion?

A Agricultural activities in the areas are linked to elevated loads of nutrients.

Q When you say elevated loads of nutrients, elevated in relation to what? 09:40AM

A From what you can expect from undeveloped watershed.

Q Undeveloped watershed?

A Yeah. 09:40AM

says that Moores Creek has been studied -- looking at Page 1, the second paragraph, and I'll quote, Moores Creek watershed has been monitored continuously from 1991 to 2004, except for a period from October '97 to December '98. Did you rely on any of the monitoring data that was collected during that period for this report? 09:38AM

A Yes.

Q Tell the court, if you would, please, what were the general subject and objectives of the research that you performed as reported in Exhibit 3. 09:38AM

A We wanted to continue to collect water quality data from Moores Creek and Lincoln Lake, and then we wanted to assess best management practices that were implemented in the watershed and how they were effective in improving water quality, and another goal was to prepare a watershed management plan and, you know, combine that with outreach training and numerous activities, and then compile that out into a project report that was submitted to the funding agency. 09:38AM 09:39AM

Q In the executive summary of this report at the -- I believe the third sentence it said sources of NPS, that would be non-point source pollution, in 09:39AM

Q All right. In that same paragraph it goes on to say, and I quote, there is ample evidence to suggest that excess land application of animal manures have led to surface and groundwater pollution due to increased runoff losses of nitrogen, phosphorus, sediment and pathogens, and it again reports or cites to Edwards in 1996. That's the same Edwards that you identified you knew? 09:41AM

A Yes.

Q Have you reviewed his study in 1996? 09:41AM

A Yes.

Q Based upon your own experience and work in the Illinois River watershed, do you believe that that statement is accurate?

MS. LONGWELL: Object to form. 09:41AM

A Yes.

Q Since 1996 do you know whether or not there's been additional gathering of data to support the statement made by Edwards in your report in Exhibit 3? 09:42AM

A There has been lots of data collected at different -- especially in this case.

Q And in your opinion has the data that's been collected support opinion that there is increased runoff of losses of nitrogen and phosphorus, 09:42AM

sediment and pathogens occurring from the land application of animal manures in the IRW?

MS. LONGWELL: Object to form.

A Some of the data that I've seen relate to nitrogen, phosphorus and sediments, yes. 09:42AM

Q Okay, and have you seen data with regard to bacteria runoff?

A I've not.

Q Have you reviewed published literature regarding whether the land application of poultry manure results in bacteria runoff in the Illinois River watershed? 09:42AM

A I've not.

Q When this speaks to the use of animal manure, do you know what that includes? 09:43AM

MS. LONGWELL: Object to form.

A Animal manure includes poultry litter as well as manure from grazing animals in the pasture, such as beef and dairy cows.

Q All right. In your work in the Moores Creek area, can you tell the court whether or not the Moores Creek watershed had what we refer to as a point source discharge or wastewater treatment plant contained within it? 09:43AM

A Moores Creek watershed does not have a point source discharge. 09:44AM

Q All right, and did you yourself collect data as part of this report in Exhibit 3 within the Moores Creek watershed?

A Yes. 09:44AM

Q What kind of data were you collecting?

A We were collecting lots of sediment data, lots of water samples from Moores Creek and biological samples.

Q Did you then analyze that data? 09:45AM

A Yes, I analyzed some of the data. Some of the other data were analyzed by Dr. Marc Nelson from AWRC.

Q All right, and did the two of you collaborate then in preparing this report that we see as Exhibit 3? 09:45AM

A Yes.

Q Based upon your analysis of the data, this says that on Page 5 -- if you'll look at Page 5 of the report, it says at the last sentence of the first -- top of the paragraph there or at the top paragraph last sentence it says, quote, the P loads for Moores Creek is similar to other watersheds with most of the phosphorus transport occurring during storm events. What does that mean? 09:45AM 09:46AM

A We compared phosphorus load in this watershed to other original watersheds, including Illinois River basin, some of the watersheds -- Beaver Lake watershed, and what we found, that the range of the loads were very similar to these other watersheds, 09:46AM and if you partition the load between base flow and storm flow conditions, majority of the phosphorus was being transported during storm flow conditions.

Q Okay. Is storm flow conditions another term for high flow conditions? 09:46AM

A Yes.

Q All right, and were you able to determine the source of the nutrient loads that occurred during storm events?

A Since there is no point source present in the 09:47AM Moores Creek, the source of nutrients coming during storm flow were non-point sources.

Q And so the court understands and so do I, what generally are the non-point sources found in the Illinois River watershed, in particular Moores Creek? 09:47AM

A So that broadly speaking, you know, you can have -- like any other watershed, there is always some background phosphorus present, and then land application of poultry litter, manure from grazing 09:47AM animals and then there may be some failing septic systems in the watershed. So those will be probably main categories in the watershed.

Q The main categories?

A Yes. 09:48AM

Q Now, this refers to other watersheds. Let's look at Page 27 of this Exhibit 3, and there's a table there. Does this Table 3 list the six watersheds that you were referring to in this exhibit? 09:48AM

A Yes.

Q And so these are the six watersheds that you were comparing that were -- that form the basis of your previous response; is that true?

A Yes. 09:48AM

MS. LONGWELL: Object to form.

Q So that I understand also, tell the court what you mean by the term phosphorus transport when you use that in this report describing phosphorus transport occurring during storm events. 09:49AM

A It measures how much phosphorus is moving past the monitoring station, and it includes phosphorus that may be transported from landscape or hill slopes into the stream and then within the stream through the flowing water. 09:49AM

Q Okay. From this report then and based upon your knowledge, experience and professional review of published literature, do you have an opinion when most of the phosphorus transport from fields to water bodies occur in the Illinois River watershed? 09:49AM

MS. LONGWELL: Object to form.

A Yes.

Q And when is that or what is your opinion?

MS. LONGWELL: Objection.

A From field to water bodies, it happens during storm flow events. 09:50AM

Q On Page 18 of your report, there is a statement I would like to ask you about in the first sentence of the first full paragraph. It says, and I quote, from a purely economic perspective, producers are best served by avoiding best management practices. Did I read that correctly from the first sentence there, Dr. Chaubey? 09:50AM

A Yes.

Q Can you tell the court what you meant by that statement in this report? 09:50AM

A We were looking at cost benefit analysis of different best management practices and comparing that to the baseline, and I believe I have defined the baseline somewhere here in this report. So most 09:51AM

of the best management practices, when you implement them, they are going to cost money. So if you look at it strictly from that point of view, that's what we meant.

Q All right. Did you rely on others to assist you in making that determination? 09:51AM

A The economic analysis was done by Dr. Jennie Popp from University of Arkansas and her research associate, Herman Rodriguez.

Q Did you confer with and review their work for purposes of your report shown in Exhibit 3? 09:51AM

A Yes.

Q Did you agree with the work that they performed and the analysis that they concluded?

A Yes. 09:52AM

Q Let me hand you what has been marked as Exhibit 17, Dr. Chaubey. Have you seen this document before?

A Yes.

Q Can you tell the court what this document is? 09:52AM

A It is watershed management plan for upper Moores Creek. It was part of the Moores Creek project that you showed in Exhibit 3, and it was prepared as a part of that project.

Q So one of the tasks of the report in Exhibit 3 was a preparation of a watershed management plan. Is this then that plan as shown in Exhibit 17? 09:53AM

A Yes.

Q And did you contribute to the creation of Exhibit 17, the watershed management plan? 09:53AM

A Yes.

Q Do you know who else may have contributed?

A My team members, who are listed in the final report on Exhibit 3.

Q All right. When you completed this watershed management plan, what did you do with the actual report; did you give it to somebody or distribute it in some form? 09:53AM

A Yes. I submitted it to Arkansas Soil & Water Conservation Commission. It's a new name now. 09:53AM

Q Arkansas Natural Resource Commission?

A Arkansas Natural Resource Commission, as a part of the final report.

Q Have you reviewed this document before submitting it I assume? 09:54AM

A Yes.

Q Looking at Page 7, I want to ask you about some statements made there, and it says -- at the bottom paragraph starting with the second sentence, it says, and I quote, according to the University of Arkansas Cooperative Extension Service, parens, CES, end parens, only about 5 percent of the ration fed to the cattle in northwest Arkansas is from off-farm sources. I believe the first sentence says, and perhaps to put it in context, the impact of unconfined cattle on water quality has not been thoroughly researched in Arkansas as that of confined animal manure management. I really kind of butchered this. I'm reading these all out of order. Let me start over. There's actually three sentences there that put this in context. Let me start over, Dr. Chaubey, and I apologize. 09:54AM

Reading the first sentence again, the impact of unconfined cattle on water quality has not been thoroughly researched in Arkansas as that of confined animal manure management. It then says, according to the University of Arkansas Cooperative Extension Service, CES, only about 5 percent of the ration fed to cattle in northwest Arkansas is from off-farm sources; therefore, it may be safe to assume that pastured cattle do not contribute heavily to the nutrient mass balance of the watershed. Can you tell me what that means? 09:55AM

A What we meant was because there is not a lot of import of nutrients coming to feed the cattle in 09:56AM

the watershed which are grazing, they are primarily recycling the nutrients within the watershed.

Q Okay. I'm going to change subjects on you a little bit now. When you were at the Arkansas Water Resource Center -- 09:56AM

A Can we take a real quick break?

Q We can take a break.

MR. GARREN: We're going off the Record for just a second and we'll be back shortly.

(Following a short recess at 9:56 p.m., 09:56AM proceedings continued on the Record at 10:02 a.m.)

Q Dr. Chaubey, when you were in the Arkansas Water Resource Center working with them, did you have an opportunity to do any work called or referred to as mass balance? 10:02AM

A Yes.

Q Tell the court, basically what does mass balance mean?

A Mass balance involves -- basically it's similar to balancing your checkbook, what comes in 10:03AM and what goes out, and the difference is how much gets accumulated. So we were doing that in the context of nutrients, how much nutrients are getting in the watershed, how much are getting out and then what gets accumulated. 10:03AM

Q When you say we, who are you referring to?

A Myself and my graduate student, and I had done this work with Dr. Marc Nelson.

Q What is the name of the graduate student that did your work? 10:03AM

A Kati White.

Q Let's look at another exhibit here. I'll hand you Exhibit 15. Have you seen that document before?

A Yes.

Q The document is entitled Illinois River 10:04AM Phosphorus Mass Balance Computation Draft, and it has the name of Dr. Nelson, Kati White and your name on the front page. Just for the Record, I'll let it note that this has a Bates number of an ADEQ 2007 915. Can you tell the court, if you would, please, 10:04AM what is this document?

A It was a draft report from the mass balance study that we had done for phosphorus in the Illinois River watershed.

Q What was the time period this mass balance 10:05AM work was being performed?

A I believe we were looking from 1997 to 2001, around that period.

Q The data that's reported in this Exhibit 15, do you know whether or not -- or what was the source 10:05AM of the data?

A We looked at a number of sources for the data. Water quality data came from Arkansas Water Resources Center and Dr. Marc Nelson, and then we looked at USDA agricultural statistics reports. We 10:05AM looked at fertilizer sale data in the two counties where this watershed is located in Arkansas. So there were a number of different sources. Some of the point source data came directly from the municipalities that have got the best water 10:06AM treatment plants in the watershed.

Q If we look over at the third page of this document, which is Bates number 0917, the title of this spreadsheet says Illinois River Phosphorus Mass Balance Inputs. Does this to your knowledge list 10:06AM the inputs that were identified and considered in your work?

A Yes.

Q Tell the court, what generally are those inputs? 10:06AM

A So they are in two different categories, point sources and non-point sources. Point sources are effluent discharge from four wastewater treatment plants that are located in the watershed, and the non-point sources are sludge application, manure 10:07AM

from different animals, including swines, hogs, broilers, layers, turkeys, cattle beef, dairy, and also inorganic fertilizer.

Q The numbers that are shown in columns across from the categories that you just described, what do 10:07AM they represent?

A They represent the amount of phosphorus from these different sources in different years from 1997 to 2001, and then various numbers for all these five years. 10:07AM

Q And did the -- do I see in the last column of this document percentages; is that what is represented there?

A Yes.

Q What are those percentages representing in the 10:08AM context of this document or this page?

A In the mass balance, when you look at the input, what its category represents as a percentage of the total input.

Q And so each category then is summed to a 10:08AM percentage; is that what you're saying?

A Yes.

Q And in the column just to the left of that, what does that column represent, the percentages that we see there? 10:08AM

A They represent within each category what the percent is. For example, there are four wastewater treatment plants, so in terms of percentage, how much each is contributing. Sum total of the four is 100. 10:09AM

Q Are the percentages that we see there, are they a total of the phosphorus that's listed in the years or is it based upon the average that is totaled or created in this document; do you know?

A Ask that again, please. 10:09AM

Q The percentages, the smaller percentages within the categories that are shown in the next to last column, are they based upon totals of these numbers or what, if you know?

A You know, I don't remember whether it was 10:09AM based on average or whether -- it may have been based on average but I'm not sure.

Q Okay. Tell us what the document says is the total inputs for the point source items listed there. 10:09AM

A Can you ask that again?

Q Can you tell me what the percentage reads on this document for the point source total input?

A It says 2.8 percent.

Q And in the non-point source categories, there 10:10AM

is one for sludge. What is the percentage listed for sludge?

A It says 3 percent.

Q And then in the final category for what is sum of animal inputs of phosphorus, what is the 10:10AM percentage listed there?

A 91.9 percent.

Q And what do you see as the percentage for phosphorus input for fertilizer in this document?

A 5.1. 10:10AM

Q This is listed as a draft. Do you know whether or not additional drafts were created or not?

A There were some other drafts after this I believe. 10:10AM

Q Let me hand you what has been marked as Exhibit 16. Have you seen this document before?

A Yes.

Q And for the Record I'll note it's the same title, but at the bottom right-hand corner it has a 10:11AM Bates number OSRC 06921.

MS. SOUTHERLAND: Say the Bates number again, please, Rick.

MR. GARREN: OSRC 6921.

Q What is this document, sir, Dr. Chaubey, if 10:11AM

you know?

A It is, again, a phosphorus mass balance computation, part of the same study, where it shows some figures and some tables with some of the calculations that we had performed for that study. 10:11AM

Q While you were working on this project, is this the kind of documentation that you would have been reviewing?

A Yes.

Q I notice this has on Page 6924 a graph. Just 10:12AM describe generally what this graph is portraying.

A It is showing concentration of total phosphorus that has been measured by Arkansas Water Resources Center from 1997 to 2001, and it is showing a trend in total phosphorus during storm and 10:12AM base flow conditions.

Q All right. The storm is represented -- storm flow is represented by the square symbol; is that correct?

A Yes. 10:13AM

Q And is that the upper -- is that the top line of the three lines that are portrayed on this chart or graph?

A Yes.

Q What is the middle line portraying? 10:13AM

A It is portraying the -- I believe these are -- it's hard to see in this figure -- diamonds, right, and that is portraying total phosphorus concentration for overall data.

Q All right, and so then the last -- the bottom 10:13AM line would be the base flow total phosphorus milligrams per liter?

A Yes.

Q All right. Did your name appear on the final version of the mass balance report when it was 10:13AM prepared?

A No, it was not.

Q Why was that; can you tell the court, please?

A The team wanted to present the results in annual conference of American Water Resources 10:14AM Center, and just there was not enough time for me to review the final set of calculations and reports, and so I voluntarily took my name off because of the time constraints and because of not having to review before it was presented. 10:14AM

Q All right. Was your choice to leave your name off -- did the contents of the report have anything to do with that choice?

MS. LONGWELL: Object to form.

A No. 10:14AM

Q Let me hand you what's been marked as Exhibit 8. Have you seen that document, Dr. Chaubey?
A Yes.
Q Tell the court what that document is.
A It is Arkansas Water Resources Center report titled Illinois River Phosphorus Sampling Results and Mass Balance Computation. That has been prepared by Marc Nelson, K. L. White and T. S. Soerens. 10:15AM
Q What was Dr. Soerens' involvement in the project for this mass balance? 10:15AM
A I believe he was involved in review and discussion of some of the computational approaches and results.
Q When you were involved directly in this project, did you have discussions or conferences with him? 10:15AM
A Yes. I have talked to him about it a few times.
Q All right. Is this then the final report for the work that we talked about as partially depicted in Exhibits 15 and 16? 10:16AM
MS. LONGWELL: Objection.
A Yes.
Q Have you read this report? 10:16AM

A I have read it before, yes.
Q Okay. Do you agree with the conclusions found within this report?
MR. GEORGE: Object to form.
A Yes. 10:16AM
Q Did the sampling events used in this project of mass balance include high flow or base -- let me just do it that way. Did the sampling utilized in this project contain high flow data?
MS. LONGWELL: Object to form. 10:17AM
A Yes.
Q Did it also have base flow or low flow data considered in it also?
MS. LONGWELL: Object to form.
A Yes. 10:17AM
Q Let's look at Page 12 of this document. Before we do that, so it isn't confusing, let's look at Page 2 because I think this is important to understand. Tell the court what the study area was for what is referred to as this mass balance computation. 10:17AM
A The study area, we call it IRDA, Illinois River drainage area. It relates only to the portion of the Illinois River watershed that drains through Highway 59 bridge sampling station, and it does not include Flint Creek and Baron Fork. 10:18AM

Q All right. So if we look at Page 2, and there is a diagram of the watershed there, is there not?
A Yes.
Q And the darker portion of that diagram on the Arkansas side is what you've referred to as that IRDA, the Illinois River drainage area? 10:18AM
A Yes.
Q All right, and the sampling that was conducted in this IRDA, where were the sampling locations generally; was there only one, or was there more than one within this IRDA; do you know? 10:18AM
A Please ask that again.
Q Do you know where the sampling gauges -- let me ask this: Do you know how many sampling gauges were utilized in this mass balance? 10:18AM
A One.
Q All right, and its location is where?
A At Highway 59 bridge.
Q And is that the location at the border where the Illinois River enters the state of Oklahoma? 10:19AM
A Yes.
Q All right. There's a statement made at Page 12 of this document I'd like to read to you and ask you what it means. The last sentence of that paragraph above the Table 5, it says, and I quote, if the PS, that means point source, discharges were reduced to zero, this analysis shows that the combined concentrations would still greatly exceed the standard. Did I read that correctly? 10:19AM
A Yes.
Q Do you know what the standard is that's being referred to?
MR. GEORGE: Object to form, calls for speculation. 10:20AM
A I believe it is referring to .037 milligrams per liter.
Q Look at Page 11, sir, if you would. In the very first sentence of that first paragraph, it says recently the Oklahoma Water Resources Board proposed, and the Oklahoma governor approved, that the Illinois River in Oklahoma be adopted as a scenic river in Oklahoma and there be a numerical in-stream phosphorus limit of .037 milligrams per liter. Is that what you believe to be the standard referenced on Page 12 that we talked about? 10:20AM
A Yes.
Q Now, let's go back to Page 12 and the table and that statement. Looking at the combined numbers that are shown as -- well, let me back up. The 10:20AM

table is identified as current and potential concentrations milligrams per liter at different point source discharges; is that correct?
A Can you ask that again?
Q Is that the name of the table that I just read? 10:21AM
A The current and potential concentrations at different point source discharges, yes.
Q All right. What are the different point source discharges that are listed in this table that we're observing? 10:21AM
A The point source discharges from four wastewater treatment plants which are discharging in the watershed.
Q All right. Looking at the combined levels rather than base and storm, at the far right column can you tell us what the heading WWTP at zero MGL/L -- MG/L, can you tell me what that means? 10:21AM
A It represents the concentrations that can be expected when wastewater treatment plants are 10:22AM discharging phosphorus at zero milligrams per liter concentration, in other words, no phosphorus effluent coming from wastewater treatment plants.
Q And so the number that's reflected there reflects what; what is the source of the P 10:22AM

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concentration listed then in that column if we have zero effluence from the wastewater treatment plant?
A So that would be coming solely from non-point sources.
Q The combined non-point source discharges shown in this column, is that the 0.246 number at the top? 10:22AM
A Yes.
Q And so that represents phosphorus that's been sampled at the 59 Highway bridge as it discharges from Arkansas in the IRDA as you've defined in this study? 10:23AM
MS. LONGWELL: Object to form.
Q As to non-point sources. Let me rephrase that. As to the non-point source discharges, is that the combined phosphorus concentration that was sampled at the bridge at Highway 59? 10:23AM
MR. GEORGE: Object to form.
A No. This was not sampled. This was an estimate that we can expect the concentrations to be. So this was not a measured concentration. This 10:23AM is what we estimated.
Q All right, and how did that estimation occur?
A Looking at different point and non-point source contributions and then reducing the point sources by certain percentages and then converting 10:24AM

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the mass into concentrations to reflect that scenario.
Q All right. Are the land uses within that subbasin quantified?
A Yes. 10:24AM
Q Are the land types in the basin quantified?
A What do you mean by quantified?
Q Well, whether it be pasture, urban.
A Yes, that's land use, yes.
Q All right. What was the largest land use found in this IRDA? 10:24AM
A Pasture.
Q And what was the next largest land use or land type?
A Forest. 10:24AM
Q And do you know how large urban was in this IRDA?
A It was not very large. It was in single digits. I don't remember. It may be somewhere in the report, but less than 10 percent. 5 or 6 10:25AM percent, 6 percent.
Q What was the primary source of phosphorus on the pastures in this study area?
MR. GEORGE: Object to form, calls for speculation, and you are soliciting new opinions. 10:25AM

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MS. LONGWELL: Object.
Q Did you undertake a determination, sir, of what the inputs were to pastures?
A Yes.
Q And what did you do -- how did you do that? 10:25AM
A So we looked at the possible sources that are listed in one of the tables here in the mass balance. We looked at the -- we looked at Page 6, what are different significant animal sources there, and we found that to be hogs, swines, broilers, 10:26AM layers, turkeys, cattle beef and dairy, and then we looked at national agricultural statistics and Arkansas statistics numbers to determine how many of these units may have been present in different years in the watershed. Based on that and based on the 10:26AM standards, we estimated how much manure was produced and applied in the pasture areas. We also looked at inorganic fertilizer sale data and estimated how much of that may be applied in the watershed and determined that number. 10:26AM
Q All right. If we look at Table 2 on Page 6, and let's just look at the year 1997 column under the animals, what do you determine to be the largest contributor of the phosphorus in that -- under those categories? 10:27AM

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MS. LONGWELL: Object to form.
A It was broilers.
Q In relation to the total inputs -- let me rephrase that. If you add all of the poultry products in your head, can you tell me approximately what the total kilograms of phosphorus are shown in 1997 as an input? 10:27AM
A About 1.8 million kilograms.
Q And what is the total inputs, including effluent, sludge and animals shown for the year 1997? 10:27AM
A About 3.1 million kilograms.
Q All right. So based on that, do you have an opinion what is the largest source of P inputs to the Illinois River drainage area that you studied in Moores Creek? 10:28AM
MS. LONGWELL: Object to form.
MR. GEORGE: Object to form.
Q I'm sorry. In that drainage. I said Moores Creek. Based upon those two numbers that you just recited, do you have an opinion what is the largest P phosphorus contributor to that area in your study as Exhibit No. 8? 10:28AM
MS. LONGWELL: Object to form.
MR. GEORGE: Object to form. 10:28AM

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A Broilers.
Q All right. Look at Page 8, if you would, please, Dr. Chaubey. The first sentence in the third paragraph, it says a key concept for understanding this interpretation of the phosphorus mass balance is that once phosphorus is in the stream, it is not being removed from the stream, except downstream. Can you tell me what that means? 10:29AM
MS. LONGWELL: Object to form.
MR. GEORGE: Object to form, calls for speculation. 10:29AM
A What it means is that once phosphorus is delivered to the stream, it will eventually be transported downstream, and it is not removed by any other mechanism. 10:30AM
Q All right. So from that, if the stream leads to Lake Tenkiller, will the phosphorus ultimately end up in Lake Tenkiller?
MS. LONGWELL: Object to form.
MR. GEORGE: Object to the form. 10:30AM
MS. LONGWELL: Calls for speculation.
A It will be transported down the stream and eventually can be expected to reach there.
Q The reservoir?
A Yes. 10:30AM

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Q All right. In this same paragraph it says, it may take several life cycles or several storm events to move from the headwaters of the system to the state line, but it all eventually does. Is that -- let me ask it this way: When you referred to the state line, is that because this particular study was measuring only at the state line? 10:31AM
MR. GEORGE: Object to form. Dr. Chaubey is not the author. He's not referring to anything.
Q Let me ask you this, sir: When you were working with Soerens, White and Nelson, I believe you said that the gauge that was used for this IRDA was at 59 Highway bridge; correct? 10:31AM
A Yes.
Q Is the sentence, it may take several life cycles or several storm events to move from the headwaters of the system to the state line, but it all eventually does, is that because that's the only gauge that you had available in this mass balance study? 10:31AM
MS. LONGWELL: Object to form.
MR. GEORGE: Object to form, leading.
A The extent of this study was IRDA, and it stopped at the state line.
Q All right. 10:32AM

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A So there were no calculations performed for any part of the watershed beyond that.
Q Okay, but let me ask you this then: Based on that and your knowledge of what occurs in this portion of the stream, is there any reason to expect that the phosphorus in the water would act differently past that gauging station? 10:32AM
MS. LONGWELL: Object to form.
MR. GEORGE: Object to form.
A No. 10:32AM
Q Is the concept of movement of phosphorus in streams commonly known within the scientific community in your opinion?
A Yes.
Q Based on your knowledge, skill, education, training and of review of published literature, do you have an opinion if nutrients are eventually delivered to downstream water bodies, such as lakes and reservoirs, once they reach the stream? 10:33AM
MS. LONGWELL: Object to form. 10:33AM
A Yes.
Q What is that opinion?
MR. GEORGE: Object to form.
MS. LONGWELL: Objection.
A Once phosphorus is delivered in the streams, 10:33AM

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it eventually makes its way downstream.
Q Let me ask you a hypothetical. If there was -- if there was no more land-applied poultry waste in this IRDA, will there be continued loading of nutrients to the water? 10:34AM
MS. LONGWELL: Object to form.
MR. GEORGE: Object to form, seeks expert opinion that's not timely disclosed.
A Yes.
Q If there was a cessation of land application of poultry waste in the entire Illinois River watershed, is there -- do you expect a continuation of loading to the water of nutrients? 10:34AM
MS. LONGWELL: Object to form, calls for a non-disclosed opinion. 10:34AM
A Yes.
Q Sitting here today, based upon your knowledge, experience, training, your review of published literature, can you make an estimate of the length of time it would take, without further land application occurring, for the nutrient concentrations in the Illinois River watershed to return back to a baseline or a more normal level? 10:35AM
MS. LONGWELL: Object to form.
MR. GEORGE: Object to form, calls for new 10:35AM

and undisclosed opinions.
A I've not made that calculation, but based on some of the other modeling that I've done in other watersheds, it can be done, and my best guess will be it will be a long time. 10:35AM
Q All right. When you say based on your experience and other modeling, can that answer be reached through modeling?
MR. GEORGE: Object to form.
Q Let me ask it this way: Can you quantify the amount or -- amount of time it would take or estimated to be taken to return to that normal level if there was a cessation of poultry litter application? 10:36AM
MR. GEORGE: Object to form, calls for speculation. 10:36AM
MS. LONGWELL: Object.
A It can be determined.
Q All right, and that would be determined through use of a model? 10:36AM
A Yes. That will be the most efficient way to do that.
Q All right. Let's talk a little bit about models. What kind of models exist that could be used to run that scenario and get a result or a 10:36AM

conclusion?
MS. LONGWELL: Object to form.
A There are a number of watersheds and water quality models of a level today that can be utilized to look at this type of question and see how water quality would change over time. 10:37AM
Q What would be an example of some of those models that could be used?
A You can use a model like SWAT, a SWAT water assessment tool, and AGNPS, A-G-N-P-S, HSPF. There are a number of other models. 10:37AM
Q Are you familiar with the GLEAMS model?
A I am somewhat familiar with GLEAMS model, yes.
Q All right. If you used a GLEAMS model with a routing equation, could that be a type of model that could run the scenario we're talking about and determine the length of time we're asking about? 10:37AM
MS. LONGWELL: Object to form.
MR. GEORGE: Object to form, lack of foundation, calls for speculation. 10:38AM
A You can interface the GLEAMS model, which is a field scale model, with the routing model, to represent watershed processes and use that to answer these type of question. It is possible.
Q Okay. Have you had an opportunity to review 10:38AM

any data for water quality at the Highway 59 bridge after the mass balance of 2002 was performed?
A I did some SWAT modeling in the same portion of the watershed where we utilized the data collected at Highway 59 bridge to calibrate and validate the model. 10:39AM
Q Was there a change that occurred with regard to the inputs after 2002 that you're aware of, the phosphorus inputs?
A Some of the point source numbers significantly changed. 10:40AM
Q And how did they change?
A The concentrations of phosphorus that was coming from the effluent discharged by the Springdale wastewater treatment plant decreased substantially, and I believe during similar time period, or it may have been slightly before that, dissolved solids also improved at the wastewater treatment plants and effluent discharge reduced from them also. 10:40AM
Q With the reduction of the wastewater treatment plants, how would that impact the respective percentages of the inputs of point and non-point sources?
MR. GEORGE: Object to form. 10:41AM

A So if the total numbers that you measure at Highway 59 bridge does not change, if that stayed the same, then percentage of point source contribution would decrease and percentage of non-point source contribution would increase, but if the numbers go down similarly, then you may have to look at that data.

Q Okay. In your professional experience and review of published literature, are you aware of any published paper that contradicts the findings and conclusions shown in Exhibit 8? 10:41AM

MS. LONGWELL: Object to form.

A No.

Q Based on the numbers on Table 2, Page 6 that you talked about earlier, the 1.8 million kilograms in 1997 versus the total input of 3.1 million kilograms, and based upon your knowledge, skill and education and training, including review of published literature, do you have an opinion whether poultry production practices of land applying waste is a substantial contributor of the phosphorus to the overall phosphorus loads within the watershed? 10:42AM 10:43AM

MS. LONGWELL: Object to form.

MR. GEORGE: Object to form, vague, calls for an expert opinion that's not been found by this

witness.

A Yes.

Q And what would be that opinion?

MR. GEORGE: Same objection.

A Based on inputs, poultry litter is the dominant source of phosphorus in the watershed. 10:43AM

Q All right. Is there anything else in your knowledge, experience that you rely on in making that opinion besides this Table 2?

MS. LONGWELL: Object to form. 10:43AM

A Other litter from this watershed and other watersheds and published journals and reports from others.

Q All right. Let's talk a little bit about some terminology. Are you familiar with the term surface runoff and -- well, let me just ask that. Are you familiar with that term? 10:44AM

A Yes.

Q In a hydrologic concept, can you tell the court what that means? 10:44AM

A What it means is when it rains, part of the precipitation travels through the soil surface or land surface, and that is primarily the surface runoff. It can also represent some of the water that travels partially through the subsurface but 10:44AM

emerges as a surface flow before it gets into the stream.

Q All right. Let me ask you about another term then, and that's infiltration. Can you tell the court what that term means? 10:45AM

A Infiltration is a process by which part of the precipitation enters the soil profile.

Q And I have one other term I want to ask you about, and it's called evapotranspiration. Can you tell the court what that means? 10:45AM

A So evapotranspiration is part of the water balance that gets sent back to the atmosphere via two different processes. One is the evaporation either from freestanding water or it could be from soil surfaces or from the water that is intercepted by canopy and then gets evaporated back into atmosphere, and second process is transpiration that represents the amount of water that plants transpire. 10:46AM

Q And that's transpired where? 10:46AM

A Back to the atmosphere, and the two terms combined represent evapotranspiration.

Q Okay. Other than -- and, again, in the context of hydrology, in a watershed, other than runoff, filtration or evapotranspiring, is there 10:46AM

anything else that can happen to water that falls within that watershed as rain?

A These are dominant pathways, but it can be retained on the surface for extended period of time. So it depends on what is your time period of interest, and unless you are looking for a really, really long period of time, part of precipitation can be retained in surface depressions and may not be part of infiltration, runoff or evapotranspiration. 10:47AM

Q Okay. Other than those four possibilities, is there anything else that can happen to water that falls as rain on the land surface within the watershed?

A Not really. 10:47AM

Q All right. When rain water infiltrates, does it become considered part of the groundwater?

A Two things can happen after the infiltration. If it travels below root joint of the plants growing in the field, then usually it is considered to travel deep enough to be part of the groundwater. It is also possible that it can travel near surface but beneath the top of the surface as a lateral flow and really not contribute to the groundwater but, you know, appear back either in springs or become 10:48AM

part of the runoff. So not all infiltrated waters becomes part of the groundwater. It depends upon how deep that it travel and what is the direction of the travel. If it continues to go vertically, then we know it becomes groundwater. Otherwise, it may not.

Q I think you said earlier, and so I'm clear, can groundwater become surface water, like especially in the Illinois River watershed?

A During base flow conditions, groundwater is what supports the stream flow in all the rivers. So it is supporting surface flow during dry periods.

Q Is that the water that you might see that seeps out of rocks near creek beds or streams; is that an example of groundwater supporting surface water?

MS. LONGWELL: Object to form.

A Yes.

Q Okay. Can surface water become groundwater in the IRW?

A In all watersheds, surface water can become groundwater in streams.

Q Let me hand you Exhibit No. 4, Dr. Chaubey. Have you seen and are you familiar with this Exhibit 4 that's entitled A Report, Stream Quality Impacts

of Best Management Practices in Northwestern Arkansas Basin?

A I have read this paper before.

Q Okay, and do you know the primary author, D. R. Edwards, listed there?

A Yes.

Q Are you also familiar with T. C. Daniel?

A Yes.

Q Are you familiar with any of the other authors listed here?

A I am familiar with H. D. Scott, J. F. Murdoch. I am not familiar with the last two authors.

Q All right. This is the document that was cited earlier in Exhibit 3, your final report for optimizing BMPs that we talked about, is it not?

A Yes.

Q Did you have confidence in this report when citing it in your Exhibit No. 3 study?

A Yes.

Q The portion where it says introduction, the very first sentence says that water quality impacts of agricultural production practices have been a matter of public concern in the United States for decades. Do you know from your own personal experience, knowledge and training if that is a true

statement?

A Yes.

Q And is it a true statement?

A Yes.

Q Is there anything that may have occurred since 1996 when this was published that would change your opinion about the accuracy of that statement?

A No.

Q There is another statement that continues in the second sentence in the introduction. It says, there is ample evidence to indicate that in general terms practices, such as row crop production and animal manure application, can lead to increased concentrations of nitrogen, phosphorus, solids, microorganisms and other substances in surface waters that receive runoff from agricultural source areas. Based upon your own knowledge, personal experience, study, investigation, review of published literature, do you believe that to be an accurate statement?

MS. LONGWELL: Object to form.

A Yes.

Q Is there anything since 1996 that you have learned, studied or reviewed that would indicate a change in your opinion from agreeing with that

statement?

MS. LONGWELL: Object to form.

A No.

Q Dropping down in that same paragraph, it goes on to say, and I quote, the potential impacts of excessive concentrations of pollutants, such as those just mentioned, are well known and include accelerated eutrophication, see for example, Sharpley, et al, 1994, and in extreme cases health hazards to humans and/or animals. Based upon your own knowledge, your investigation, research and review of published literature, do you agree that that's an accurate statement?

MS. LONGWELL: Object to form, calls for an untimely opinion.

A Yes.

Q Is there anything that's occurred since 1996 that would change your opinion about the accuracy of that statement?

MS. LONGWELL: Same objection.

A No.

Q What are some of the human health hazards that you are aware of that can occur as a result of excessive concentration of pollutants as mentioned in this paper?

MS. LONGWELL: Object to form.
A The pathogens and bacteria, we know they are health hazards to humans for different contact and for purposes of drinking water. There is water quality standard for nitrate. For example, if it is more than 10 milligrams per liter, we know it may lead to Blue Baby Syndrome. Pesticides, for example, we know that many of them have bad health consequences. 10:55AM
Q What was that again? **10:56AM**
A Pesticides. Nutrients, when the lead -- when they cause eutrophication and excess algal bloom, may interfere with water treatment processes, and if they're not removed before cloudiness, we know they form a compound called trihalomethane, or THM, that is a suspected carcinogen. So there are some hazards that have been reported quite a bit in literature. 10:56AM
Q Why don't we take about a five-minute break here and let you stretch your legs and then we'll come back and resume. Okay? **10:57AM**
A Okay.
MR. GEORGE: Rick, before we leave, do you think you're about done?
MR. GARREN: No. 10:57AM

MR. GEORGE: I'm sorry?
MR. GARREN: No. I don't know how far along I am. I've skipped some pages in my outline that I'll come back to. So I can't tell you.
MR. GEORGE: Send your outline to me and I'll tell you whether you ought to go back. 10:57AM
MR. GARREN: I'll do that. Look for an e-mail. Okay?
MR. GEORGE: All right.
MR. GARREN: We'll take five minutes. 10:57AM
(Following a short recess at 10:57 a.m., proceedings continued on the Record at 11:08 a.m.)
Q Dr. Chaubey, when we left, you were speaking about some of the health hazards that can occur as a result of excessive concentration of pollutants as listed in the Edwards article at Exhibit 4. Does bacteria within the poultry litter or waste constitute one of those health hazards? **11:08AM**
MS. LONGWELL: Object to form. 11:08AM
A Yes.
Q What are some of the health hazards associated then with bacteria in water?
MS. LONGWELL: Object to form, calls for speculation. 11:09AM

A Presence of bacteria in the water can make a person sick if that person drinks bacteria-infected water out of a stream and the water has high concentration of bacteria and pathogens.
Q Let me hand you, Doctor, Exhibit No. 12. Are you familiar with this document entitled Phosphorus SWAT Modeling in the Arkansas Portion of the Illinois River Drainage Area? **11:09AM**
A Yes.
(Whereupon, a discussion was held off the Record.) 11:10AM
Q Dr. Chaubey, tell the court what is a SWAT -- let's start over. I think you said it earlier, but so I'm sure, SWAT stands for soil and water assessment tool I believe you said; is that correct? **11:12AM**
A Yes.
Q And what does -- what is SWAT; what does it do; what is its function, if you will?
A It's watershed model that has been developed by USDA to evaluate effects of various land use and land management, climate forcing some hydrology and water quality response at various time scales and at different points within the watershed. 11:13AM
Q Did you say it was developed by the USDA; is that what I heard you say? **11:13AM**

A Yes.
Q All right, and how is it intended to be used?
A It was intended to be used in watersheds to make long-term watershed management decisions. It also says that it can be used in ungauged basins, basins where there is no major data available. 11:13AM
Q No major what?
A Data available.
Q An ungauged basin, is that what you said?
A Yeah. 11:14AM
Q Is this particular model widely used and accepted by researchers and government agencies for that purpose that you described?
A In my opinion, it is the most widely used watershed model today. 11:14AM
Q And without making an assumption here, does that mean that it's an accepted method for evaluating P loading on a watershed scale?
A Yes.
Q Has SWAT been used by any other modelers to evaluate P loading on a watershed scale? **11:14AM**
A Yes.
Q Do you or did you follow the appropriate protocols for running SWAT in the IRW when you conducted your work? **11:14AM**

A Yes.
Q We're going to maybe talk about some of those in a minute, but was the water quality data collected pursuant to what's referred to as QAPP or subject to a quality assurance and quality control protocol? **11:15AM**
A Yes. All activities in the project were done as per the QAPP or QA/QC.
Q I think throughout this Exhibit 12 you mentioned that calibration and validation was conducted on the model; is that true? **11:15AM**
A Yes.
Q And did you do it more than once; do you recall?
A Yes. We have done it a few times. 11:15AM
Q Was this model and the results that you generated approved or accepted in any way by any governmental agency?
A Yes. We had submitted a report on SWAT modeling that we did in the watershed to Arkansas Natural Resources Commission. It was reviewed by them, and I believe it was also reviewed by EPA. 11:15AM
Q If we look at Page 3 of your report, Exhibit 12, the first full paragraph at the top, does this paragraph accurately describe the objectives of the study and if so, tell us what they are. **11:16AM**

A For the study that is reported in this paper, there were two objectives. First one was to calibrate and validate the SWAT model for the IRDA, and the second objective was then to use the calibrated and validated model to look at some what-if scenarios, what if you do this in the watershed, what can you expect in terms of hydrology and water quality. 11:17AM
Q What were the what-ifs or scenarios that you were planning to and did, in fact, perform as reported in this paper? **11:17AM**
A In this paper we looked at some reductions in point source discharges, and we also looked at some reductions in poultry litter application in the watershed. 11:17AM
Q Okay. In your opinion, were the objectives as stated in this report accomplished?
A Yes.
Q Let's turn over to Page 6, if we could, please, and there's a table there at Table 6. Do you see that document and that table? **11:17AM**
A Yes.
Q Tell us what this table portrays or depicts.
A It shows some of the scenarios that we modeled using the calibrated and validated SWAT model and the respective inflow phosphorus that would result from these scenarios. We looked at four possible reductions in non-point sources that was 25, 50, 75 and 90 percent decrease in non-point loadings. 11:18AM
Q Those are the four items at the top of the table; correct?
A Yes, and then we also looked at three reductions scenarios for point sources, point source concentrations equal to 1, 0.5 and zero milligram per liter, and we then looked at one combination, 25 percent decrease in non-point loadings and point source effluent concentration of 1 milligram per liter. 11:19AM
Q So I can understand and hopefully help educate those who might, like me, not fully understand what you're saying, in your scenarios are you saying that the model was run for each scenario in order to determine the what-if and then the result? **11:19AM**
A Yes. Model was run separately for each scenario. 11:19AM
Q All right, and so you changed the controls or the switches that are within the model in order to change what is the scenario that's being examined; is that a correct analysis? **11:20AM**

A We modified the input data files that represent these scenarios in the model.
Q So if we look at the last one on a decrease in non-point loadings that's listed in Table 6, when you say you modified the input files, do you reduce the amount of input by 90 percent in that scenario; is that what I should understand from this? **11:20AM**
A Yes. What you do is go back and reduce the non-point source input that is going in the model by that percentage and then run the model for that scenario. 11:20AM
Q All right. We saw earlier in one of the tables that there were inputs of phosphorus 1.8 million kilograms. For example, is that a number that you would reduce by 90 percent in that scenario; is that what you are doing? **11:21AM**
MR. GEORGE: Object to form.
A Yeah.
Q Okay. Once you have done these scenarios, the column to the right says phosphorus or percentage phosphorus load reduction. What is that number telling us for each of these scenarios? **11:21AM**
A The numbers on the second column indicates how much reduction in the phosphorus that is leaving Highway 59 bridge monitoring site can be expected as 11:21AM

it was predicted by the model.
Q So in the same scenario that I pulled out, if you have a 90 percent decrease in non-point loading, your model projected that the phosphorus -- percentage of phosphorus load reduction would then equate to 54 percent reduction; is that correct? 11:22AM
A Yes.
Q Now, tell us what you did on the -- to reduce the point source concentration. How were those scenarios modified? 11:22AM
A So from all the four point sources in the watershed, we had the dissolved rate and we had the concentrations. So we -- for example, when you look at the point source concentration to 1 milligram per liter, we changed all the concentrations to 1 milligram per liter at the reported discharge rate, and then we run the model. 11:22AM
Q And then that model gave you the percentage phosphorus load reduction in the right-hand column for each scenario; correct? 11:23AM
A Yes.
Q All right. Tell me then, when you did a combination, which is the last scenario, tell us exactly how that occurs.
A So what that shows is -- and this was one of 11:23AM

the scenarios we ran -- what will happen if you go and decrease the non-point source input by 25 percent and decrease effluent concentrations to 1 milligram per liter, what -- and it showed that a 43 percent reduction in the phosphorus load at the Highway 59 bridge gauging site can be expected. 11:23AM
Q So in your -- the one scenario, which is a combination, that shows if you decrease the non-point by 25 percent and the point source at only 1 milligram per liter as an input, the model tells you you'll have a 43 percent overall reduction in phosphorus; is that correct? 11:24AM
A Yes.
Q All right. Are there other models that can do similarly what you have done here with the SWAT model? 11:24AM
MR. GEORGE: Objection.
A There are a number of other models that can be used to get similar analysis done, and those are the models that I mentioned earlier, HSPF model and AGNPS model, field scale model linked with an industry model to represent water site processes. 11:24AM
Q Okay, and a field scale model would be one similar to GLEAMS?
A Yes. 11:25AM

Q And you link it with -- what is it you said?
A A routing model.
Q A routing model?
A Yeah.
Q Based on SWAT in your work in this, what is the largest source of P loading that you found? 11:25AM
MS. LONGWELL: Object to form.
A Non-point sources.
Q Okay, and were you able to determine which of the non-point sources were the largest of those? 11:25AM
MR. GEORGE: Object to form.
A It is difficult to parse out exactly, you know, each one of those sources. At least that's one limitation with some of the current models, but you can differentiate between point and non-point sources. 11:26AM
Q Well, let's go this way then. I think I heard you say that pasture is the largest percentage land use type; correct?
A Yes. 11:26AM
MR. GEORGE: Object to form, asked and answered.
Q We saw earlier the inputs in the exhibit, which was for 1997 1.3 kilograms, and you indicated that was the largest input; correct? 11:26AM

MS. LONGWELL: Object to form.
A Yes.
Q And I think you've said earlier that the typical and normal use of poultry litter is to land apply pastures; correct? 11:26AM
MR. GEORGE: Object to form, leading.
MS. LONGWELL: Object to form.
A Yes.
Q All right. You testified to that earlier, did you not? 11:27AM
A Yes.
Q All right, and based on that, can you yourself, based on your professional experience, training, education, working with SWAT, conclude what might be the largest source contributor of those factors? 11:27AM
MR. GEORGE: Object to form. The witness is being asked to offer an opinion that he's never before formed in his connection with his work that's been discussed in this deposition, and it's untimely and it's improper. 11:27AM
Q You can answer the question.
A There are some generalities that can be deduced from parts of the watershed from other modeling activities that I've done and have been 11:27AM

reported in literature by others. Usually the losses are proportional to the input, with few exceptions that may be there.

Q In your SWAT model, when you reduce -- in your scenarios you decrease the non-point loadings, did you decrease all of them on the same percentage or did you pick one or the other to make a decrease? 11:28AM

A You know, it has been awhile since we did this study, but best of my recollection, we went and decreased the poultry litter application rates in the watershed. 11:28AM

Q Was that the only reduction of poultry -- I mean, was that the only reduction of non-point loadings then that you performed in these scenarios? Take your time and read the report if you need to refresh your recollection. 11:29AM

MR. GEORGE: While the witness is reading, I didn't hear the last answer, Rick. Can you --

MR. GARREN: We'll read it back to you while he is reading. 11:29AM

(Whereupon, the court reporter read back the previous answer.)

MR. GEORGE: Thank you, Lisa.

A You know, again, it has been several years since we did this model application, but I believe 11:29AM

the reductions in non-point sources represent poultry litter application scenarios.

Q Okay. The Exhibit 12 that we're dealing with is the Arkansas side in your Illinois River drainage area. Have you yourself evaluated the source of P loading to the Illinois River watershed? 11:30AM

A Can you clarify that?

Q Yeah. Well, the SWAT model that we're seeing here was applied only to a portion of the Illinois River watershed; correct? 11:30AM

A Yes.

Q Have you, though, made any other types of evaluation for phosphorus loading in the Illinois River watershed?

A Do you mean some other studies or do you mean my personal observations? I am not clear about the question. 11:31AM

Q And I'm not clear in my question so I'll make it more clear. Based upon either your review of published literature -- let's start over. Have you done any specific studies in the Illinois River watershed that evaluated the P loading to that watershed yourself? 11:31AM

A The Moores Creek project, we looked at loading of phosphorus, nitrogen, sediments. Then in part of 11:31AM

my masters thesis we looked at the losses of these constituents, and the USDA project that I'm working on right now also involves these assessments.

Q And do they include the assessment for the entire watershed or only a portion of it? 11:32AM

A These include a portion of the watershed.

Q All right. Have you ever done an evaluation or reviewed then literature that has evaluated the source of P loading to the entire Illinois River watershed? 11:32AM

A Except this mass balance study, I am not familiar with any other watershed assessment.

Q Are you, through your research, study, review of published literature, aware of any significant P loading from land in the Illinois River watershed? 11:32AM

A Ask that again.

Q Based upon your studies, review of published literature, are you aware of any significant P loading that has been determined that comes from land in the Illinois River watershed? 11:33AM

A Yes.

Q Tell us what you've learned.

A For example, again, the Moores Creek watershed, which has got only non-point sources present in the watershed, the amount of phosphorus 11:33AM

and other nutrients which are delivered represent the amount that is coming from the landscape.

Q Is there any reason to believe that the rest of the Illinois River watershed would behave differently than the results you've seen in your studies in your Illinois River drainage area or Moores Creek? 11:34AM

MS. LONGWELL: Object to form.

MR. GEORGE: Object to form, calls for speculation. 11:34AM

A No. Land use and land management is similar, and so I would expect it to indicate a general trend.

Q Dr. Chaubey, looking at the Table 6 again at Page 6, assuming your memory is correct with regard to reductions from poultry in this model scenario, if poultry is reduced by 90 percent in non-point loadings, is the resulting phosphorus load reduction then an amount of 54 percent; is that correct? 11:35AM

MR. GEORGE: Object to form, lack of foundation, vague, calls for speculation. 11:35AM

A Yes.

Q If -- so if we look at the scenario above it at 75 percent, if you reduced poultry inputs by 75 percent, what is the phosphorus load reduction that 11:36AM

your model tells you would happen?
MR. GEORGE: Same objection.
A You can expect phosphorus load reduction to be about 43 percent.
Q Let me hand you what's been marked as Exhibit 13, Dr. Chaubey. Do you know what this document is? 11:36AM
A Yes. It is water response modeling in eleven-digit priority watersheds in Arkansas. It is a final report that was prepared for this project and submitted to Arkansas Natural Resources Commission. 11:37AM
Q Okay. What was the purpose of the project?
A We wanted to establish a baseline SWAT model in eight of the priority watersheds, and those priority watersheds were determined by Arkansas Natural Resources Commission. So we wanted to establish a baseline SWAT model, and then I believe use the SWAT model to prioritize some of the subbasins based on flow, sediment, total nitrogen and total phosphorus that could be focused for some of the BMP implementation to reduce non-point source pollution. 11:38AM
Q Were you able to accomplish the project objectives?
A A number of watersheds did not have the data 11:39AM

that was needed, so we identified those shortcomings, but for the watersheds where we had adequate data, we were able to do that, yes.
Q Was the Illinois River watershed one in which you had accurate data or sufficient data also? 11:39AM
A We had sufficient -- what we felt was sufficient data for the Illinois River watershed.
Q Who is Margaret Gitau, one of the authors?
A Margaret Gitau at that time was a research associate working with me. Since then she has become faculty. She went to Purdue with me and worked there for about a year. Now she is a faculty at Florida A & M. 11:39AM
Q All right. Is this describing the model that -- let me ask you this: Was this model -- this work done on the model subsequent to your previous modeling work that we talked about? 11:40AM
A Yes.
Q Okay. Has the model been used by you since it's been updated to the eleven-digit priority watersheds? 11:40AM
A That's what we tried to do here in this project.
Q Have you applied the model to scenarios similar to what you described earlier in Exhibit 12? 11:40AM

A Well, I don't remember if we ran the same scenarios or not, but we are running some scenarios right now as part of my USDA project.
Q Look at Page 21 and maybe you can explain to me what the graphic representation tells us on that page. It's entitled Illinois River Watershed Arkansas, Subbasin Percentile Rankings Based on Swat Model Results, and then it has four categories there. What is this supposed to tell us? 11:41AM
A So one of the things that ANRC wanted us to do was to prioritize the subbasins in the watershed that were contributing different amounts of flow, sediment, total nitrogen and total phosphorus, so that it gives them a target for implementing best management practices or maybe funding 319 projects because not all areas are same and not all areas are representing same loadings. What they wanted us to do was use the SWAT model to rank, which are -- you know, you may call hotspots or areas that are disproportionately contributing to flow sediment, total nitrogen, total phosphorus, so that they could go and focus in those subbasins compared to the ones that were not contributing as much to the problem. 11:41AM 11:42AM 11:42AM
Q Does the figure then 13 on Page 21 color code those subwatersheds in accordance to the four categories that are shown on this figure? 11:42AM
A Five categories. It is broken from zero to 20, 20 to 40, and so on and so forth.
Q But we have four categories of either flow, sediment, total nitrogen and total phosphorus; correct? 11:43AM
A Yes, four outputs of interest here.
Q So each of those subwatersheds are ranked in accordance to the five percentiles that you described? 11:43AM
A Yes.
Q And in looking at this figure, are the subbasins then reflected according to the eleven-digit code as opposed to the eight-digit code? 11:43AM
A Yes.
Q Okay. I'm going to hand you what's been marked Exhibit 14, Dr. Chaubey.
MS. SOUTHERLAND: Rick, was the last exhibit you just got finished talking about Exhibit 13? 11:44AM
MR. GARREN: It was.
MS. SOUTHERLAND: Thank you.
Q Are you familiar with Exhibit 14, Dr. Chaubey?
A Yes. 11:44AM

Q And you're one of the -- in fact, you're the primary author of this document; correct?
A Yes.
Q When was the work done in this study; do you know? **11:44AM**
A This work was done in 1993, 1994.
Q What was the nature -- first off, the document is entitled Assessment of Effectiveness of Buffer Zones in Removing and it says Imputies in Runoff From Areas Treated With Poultry Litter, does it not? **11:44AM**
A Yeah, there is a typo there. Impurities.
Q Would that be impurities?
A Yeah.
Q All right. Tell us, what was it that you did in this research? **11:45AM**
A We looked at how vegetated filter strips or buffer strips can be used as a best management practice to filter sediment, nitrogen, phosphorus, pathogens and chemical oxygen demands from surface applied swine manure and poultry litter. 11:45AM
Q Where was the study conducted?
A It was conducted on a number of constructed plots within the Illinois River basin.
Q Tell me generally what are the results that you learn from this study. **11:45AM**

A What we learned was -- I believe the conclusions are somewhere in the report here, but in general, vegetated filter strips were very effective in removing sediment, ammonium nitrogen, I believe total phosphorus and phosphoric phosphorus, as well 11:46AM as COD and bacteria from runoff that were coming from surface-applied poultry litter and swine manure, and we studied up to a length of 21.4 meters. A significant portion of the constituents were retained within this land. First few feet were 11:46AM most effective, and for some of the parameters, we did not see as much effectiveness. For example, I believe it was for sediment, that we didn't see it to be as effective as other constituents.
Q Okay. This document says in the abstract that this research involved characterizing performance of fescue vegetative filter strips in improving quality of runoff from pastureland areas treated with poultry litter and swine manure. At this time frame did you know that this runoff was occurring from poultry litter and swine manure? **11:47AM**
MS. LONGWELL: Object to form.
A There were a number of published studies from work by Edwards and Daniel that had indicated that there is significant amount of losses from 11:47AM

surface-applied poultry litter and swine manure.
Q Okay. The report also says that the transport of suspended solids and chemical oxygen demand was also reduced by the vegetative filter strips but generally not to the extent of other litter and manure constituents. Can you tell me what those other manure or litter constituents were? **11:48AM**
A They were ammonium nitrogen, total nitrogen, phosphate, phosphorus, total phosphorus and fecal coliform. 11:48AM
Q Do you know which ones were not as -- where the vegetative filter strips were not as effective, as to which constituents?
A Sediment and chemical oxygen demand.
Q All right. Can suspended solids include bacteria? **11:48AM**
A Suspended solids carry -- can potentially carry a number of other constituents, and bacteria can be or has been studied both as sediment in test form and, you know, equivalent to soluble form. 11:49AM
Q Based upon your knowledge, experience and review of published literature, does bacteria travel besides in a suspended solid state?
A It can travel --
MR. GEORGE: Object to form. 11:49AM

A It can travel in the dissolved -- equivalent to a dissolved form, yes.
Q So when you say in dissolved form, would that be like a liquid state?
A It is -- it's small enough that, you know, it 11:49AM is not retained on the filters.
Q So it flows in the --
A It will be similar to -- the behavior will be similar to what you would see in the dissolved nutrients, for example. 11:50AM
Q All right. Looking at the introduction at Page 2, there's a statement there at the very top that says, and I'll read it, land disposal of animal manure is widely recognized as an economic means of productively using manure constituents as well as an effective disposal technique. Did I read that correctly? **11:50AM**
A Yes.
Q And when you put this in your report, had you done any study or investigation to support that statement? **11:50AM**
MR. GEORGE: Object to form.
A It was based on a number of papers that I had reviewed in conjunction with this study.
Q So when your paper then is produced somewhere **11:51AM**

in '93 or '94, this -- these facts about land disposal of animal manure was already known and published; is that correct?

MR. GEORGE: Objection, leading.

A There were a number of papers that indicated this fact from around the country. 11:51AM

Q Did those papers define animal manure?

A Clarify that question for me, please.

Q What was the term animal manure meaning when you used it in your report of Exhibit 14? **11:51AM**

A In a sentence like this where it is mentioned in general, it can be a wide, wide variety, you know, such as poultry, swine, dairy beef. The two animal manure types that we studied for filter strip environments were poultry litter and swine manure. 11:52AM

Q Okay. The sentence further down in this paragraph says, past research has demonstrated potential runoff quality impacts of poultry litter and swine manure application to pastures/range areas, and it cites a study by Westerman in 1983, **11:52AM** **McLeod and Hegg in 1984, Edwards and Daniel in 1992 and '93. Is that an example of some of the studies then that you relied on in your work in Exhibit No. 14, among others?**

A Yes. 11:53AM

Q So do I read this then to mean or understand that as early as the 1983-'84 time range, runoff of animal manures was documented or known?

MS. LONGWELL: Object to form.

A Yes. There were studies that were published in the period that indicated this fact at that time. 11:53AM

Q Looking at Page 6 of your report, there are a couple of other studies reported there that go back as far as '76 or '75. Did you review all of those in doing your work here; do you have a recollection? **11:54AM** **It's been awhile I know.**

A I was on the top of the literature at that time, you know, being distributed. I read all those papers, yes.

Q Okay. When you said that the land disposal of **11:54AM** **animal manure is widely recognized and also that it's an effective disposal technique, explain to me what that means.**

A Ask that question one more time, please.

Q Look at Page 2 of the introduction, the very **11:54AM** **top sentence.**

A Okay.

Q You -- in that sentence you talk about the -- that it's recognized as an economic means that using manure constituents -- I'll just read it. It says, **11:55AM**

land disposal of animal manure is widely recognized as an economic means of productively using manure constituents, as well as an effective disposal technique. What do you mean by the term effective disposal technique? **11:55AM**

A What I mean by effective disposal technique is how do you handle animal manure from these products and facilities, what gets done to them.

Q All right. If a poultry grower or farmer is land applying the poultry litter from the barn at a **11:56AM** **rate in excess of the agronomic needs of the plants, the grass, is that what you coined the term for as an effective disposal technique?**

MS. LONGWELL: Object to form, lack of foundation, calls for speculation. 11:56AM

A So when you apply poultry litter to the pasture areas, you know, you are accomplishing both components here, productivity using manure constituents because it helps with some of the nutrients, but at the same time you are also 11:56AM disposing of the poultry litter from the houses, which are produced to the surroundings areas.

Q And you say disposing of it. Why are you talking about it in the two components?

A We have -- it has been recognized that poultry 11:57AM

manure has got some useful nutrients, that when utilized properly can enhance crop production, but at the same time because of the nutrient imbalances, you know, it can lead in to some potential problems, too. So that's why I'm using -- in this sentence 11:57AM using both components.

Q If a poultry farmer is applying the poultry waste at a rate in excess of the agronomic needs, is that an appropriate use as you've used the term?

MR. GEORGE: Object to form, calls for a new opinion, lack of foundation, vague. 11:58AM

MS. LONGWELL: Objection.

A That is waste disposal in my opinion.

Q Looking at Page 10 of your report, where it -- **in the first full paragraph in the middle it talks** **11:58AM** **about and says specifically and, I'll quote, under concentrated flow conditions, however, vegetative filter strips' effectiveness was greatly reduced. Tell me what that means, if you would, please.**

A So when we designed these vegetative filter strips, we designed them to have uniform seed flow, and they are most effective under that condition. If the conditions change in a way that you have got concentrated flow, such as small channels running through the filter strip areas and flow is not 11:59AM

distributed across the width, then their effectiveness can be expected to reduce significantly.

Q Did you observe vegetative filter strips that had experienced the channelization that you just described in doing your study? 11:59AM

A In my study, no. The flow conditions were uniform, and there were seed flow conditions, and how you would, you know, ideally hope that they would work. 12:00PM

Q When you have a channelization occur, why is it there's a reduction in effectiveness?

A Because of a number of reasons. Number one, you want the water to be spread across the width of the filter strips so that there is increased 12:00PM opportunity for infiltration to take place. Number two, you want them to have maximum contact with the sediment and with the plant so that there is enhanced opportunity for adsorption and, number three, you want the water to be moving through the 12:00PM filter width slowly so that some of these processes can take place. If it is in concentrated flow, it moves through a very small portion of the filter strip very, very rapidly, and none of the three processes get any great opportunity to take place. 12:01PM

Q As a result of that, the constituents go where?

A So as a result of that, constituents may not be retained within the filter area and they may be delivered downstream. They may exit the filter 12:01PM strip area without much retention.

Q Is there a point where a buffer strip, a vegetative filter strip will stop all runoff of the constituents of poultry litter?

A There will always be some amount exiting. So 12:01PM I don't think it is realistic to think that you can design a buffer strip that will filter everything and retain everything within it. There will always be some going out. It may be a small portion of what goes in, but there will be some exiting the 12:02PM filter strip area.

Q Have you continued since this time period of this report, Exhibit 14, to review, research and follow up on buffer strips and their use?

A I read some papers from time to time. I 12:02PM cannot claim that I read all the papers that have been published on the topic, but I continue to read and review papers for different journals that are sent to me for peer review and for my opinion.

Q It's a little after noon, Dr. Chaubey. Why 12:03PM don't we take a break here for lunch and we'll resume after that and I'll ask you some questions about some buffer strips some more.

MR. GARREN: The people on the phone, are you guys going to be sticking around your office? 12:03PM Do we shorten our lunch period in order to help accommodate his schedule to leave today?

MR. GEORGE: What is Dr. Chaubey's schedule today?

MR. GARREN: His flight leaves at 5:30 from 12:03PM the Tulsa airport. So we have to leave here probably a little before 4:30.

MR. GEORGE: How much more do you have, Rick?

MR. GARREN: I anticipate a couple of 12:03PM hours.

MR. GEORGE: We may not have sufficient time for Dr. Chaubey, regardless of what we do with lunch, so --

MR. GARREN: Okay. So -- 12:03PM

MR. GEORGE: I'd say take a normal lunch break and we'll see where we are.

MR. GARREN: Okay. Be back in an hour or sooner?

MR. GEORGE: An hour would be fine. 12:03PM

MR. GARREN: Okay.

MR. GEORGE: I need to check on a family without power over my lunch hour, so I'm going to try to do that.

MR. GARREN: We're back here at 1:00 or a 12:04PM little after.

(Following a lunch recess at 12:04 p.m., proceedings continued on the Record at 1:20 p.m.)

MR. GARREN: The parties, based upon 01:20PM agreement, have determined that this portion of the deposition will end and be resumed on March 2 at 8:00 a.m. in order to allow Dr. Chaubey to get out of this airport due to inclement weather problems, and I'll resume my examination, and then we'll have 01:20PM a cross examination by the defendants at that time.

(Whereupon, the deposition was recessed at 1:20 p.m.)

SIGNATURE PAGE

I, Indrajeet Chaubey, PhD, do hereby certify that the foregoing deposition was presented to me by Lisa A. Steinmeyer as a true and correct transcript of the proceedings in the above styled and numbered cause, and I now sign the same as true and correct.

WITNESS my hand this _____ day of _____, 2009.

_____
INDRAJEET CHAUBEY, PhD

SUBSCRIBED AND SWORN TO before me this _____ day of _____, 2009.

_____
Notary Public

My Commission Expires:
_____

01:20PM

CORRECTIONS TO THE DEPOSITION OF INDRAJEET CHAUBEY, PhD
Volume I

PAGE AND LINE NUMBER	CORRECTION

C E R T I F I C A T E

STATE OF OKLAHOMA)
) ss.
COUNTY OF TULSA)

I, Lisa A. Steinmeyer, Certified Shorthand Reporter within and for Tulsa County, State of Oklahoma, do hereby certify that the above named witness was by me first duly sworn to testify the truth, the whole truth and nothing but the truth in the case aforesaid, and that I reported in stenograph his deposition; that my stenograph notes were thereafter transcribed and reduced to typewritten form under my supervision, as the same appears herein.

I further certify that the foregoing 114 pages contain a full, true and correct transcript of the deposition taken at such time and place.

I further certify that I am not attorney for or relative to either of said parties, or otherwise interested in the event of said action.

WITNESS MY HAND AND SEAL this 28th day of January, 2009.

_____
LISA A. STEINMEYER, CRR
CSR No. 386

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